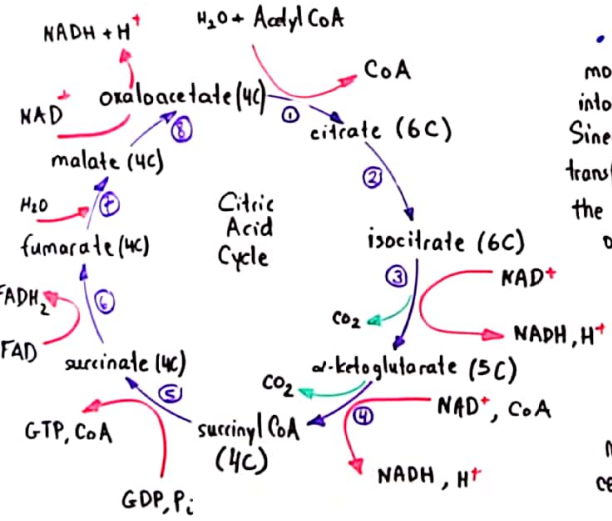
Citric Acid Cycle

- Once pyruvate undergoes oxidative decarboxylation to form acetyl CoA, the acetyl coenzyme A can then enter the citric acid cycle, also known as the Krebs cycle or tricarboxylic acid cycle (TCA). The citric acid cycle is a series of eight reactions that break down acetyl CoA, the product of pyruvate decarboxylation, to yield high-energy electron-carrier molecules such as NADH and $FADH_2$



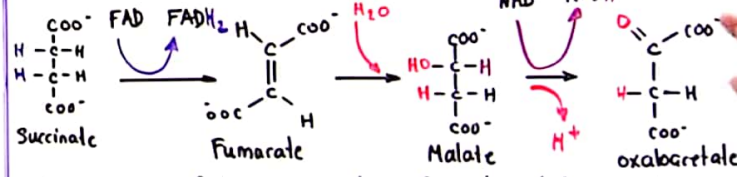
- A single glucose molecule breaks down into two pyruvates. Since each pyruvate transforms into acetyl CoA, the citric acid cycle occurs twice per glucose molecule.
- The citric acid cycle occurs in the mitochondrial matrix of the mitochondria of the cell.

- The purpose of the citric acid cycle is to harvest the "high-energy" electrons from the carbon fuel source that ultimately come from glucose.

1) **Step 1:** Oxaloacetate and acetyl-CoA react to form citryl CoA, which then reacts with water to form citrate. The purpose of this step is to create a molecule that will ultimately undergo decarboxylation.
Step 2: The hydroxyl group on citrate is not positioned correctly to undergo a decarboxylation. Therefore, citrate is transformed into isocitrate by an enzyme called aconitase.

2) **Step 3:** This is the first oxidation-reduction reaction of the citric acid cycle. Here we first reduce NAD^+ into NADH and then produce the α-ketoglutarate via an oxidative decarboxylation reaction.
Step 4: This is the second oxidative decarboxylation reaction. We form a four-carbon molecule, releasing CO_2 and forming NADH.
Step 5: In this step, we transfer a phosphate group from succinyl CoA onto a GDP to form GTP. This is the only step in the citric acid cycle that produces with a high phosphoryl transfer potential

3) **Step 6-8:** The final three steps of citric cycle involve the regeneration of the oxaloacetate molecule.



In the process of the regeneration of oxaloacetate, we also form $FADH_2$ (step 6), NADH (step 8) and use water (step 7).

Products: $4CO_2$, 6 NADH, $2FADH_2$, 2 GTP, $4H^+$, 2 CoA

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